

SOME WILDLIFE AND LAND USE RELATIONSHIPS IN OHIO

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Although the first white people who came into the Ohio Territory as hunters and trappers probably gave little or no thought to conserving, propagating or managing wild animals, it was relatively early in Ohio's history when laws were first passed to protect economically important animals. As indicated in a companion paper by Dambach to be published in a later issue of this Journal, a law was passed in 1829 to protect the valuable fur-bearing muskrat during its reproductive season. This was followed in succeeding years by other protective or restrictive legislation establishing seasons and daily bag limits according to game abundance and regulating the manner in which animals could be killed legally.

Protective legislation is only one of several methods man has used to manage wildlife species. Artificial propagation of game and fish, followed by stocking has been and still is popular with Ohio sportsmen, although numerous studies have shown that game farm birds and hatchery fish supply only a fraction of the annual harvest. Refuges have been established to provide sanctuary to game animals during and following the hunting season so that ample brood stock might remain for the following year. Such areas have been of particular value to the ring-necked pheasant and waterfowl. Granted that refuges, restocking and protective legislation play their part in wildlife management, it is apparent that in the present plight of our pheasants, our waterfowl and our Hungarian partridges, these measures have not been entirely successful.

One of the most promising management techniques is that of habitat improvement. This method is based on the hypothesis that when the environmental requirements for a given animal are satisfied it will be able to approach its biotic potential and be present in goodly numbers; conversely, if the habitat is not satisfactory, no amount of stocking or protection will result in sustained high populations of the animal. Obviously, exotic species such as our ring-necked pheasant and Hungarian partridge would not be in Ohio today if the habitat had not been suitable for their existence when they were stocked.

The Ohio Division of Conservation and Natural Resources in recognition of the necessity of providing suitable wildlife habitat, initiated a program of habitat improvement throughout Ohio in 1947. It is the purpose of this paper to indicate important wildlife-land use relationships which are involved in the development of a wildlife management program in Ohio.

WILDLIFE DURING OHIO PIONEER DAYS

Although frequent accounts were written by the early Ohio settlers concerning some of the more conspicuous animals inhabiting the area, little accurate information was recorded concerning the smaller and often more inconspicuous birds and mammals. Even today when much attention is given to the censusing of wild animals we still have but little accurate information on wildlife populations.

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We know that Ohio was originally a forested area (\approx 95 per cent) with a relatively small amount of prairie and marsh land. We know that several mammals once present in Ohio, including the fisher, timber wolf, wildcat, porcupine, snowshoe rabbit, American elk, bison, panther and marten, were extirpated because of habitat destruction, hunting or for other reasons. We also know that many birds that once occurred in Ohio are no longer present. These include the wild turkey, greater prairie chicken, raven, whooping crane and swallow-tailed kite, which although extirpated from Ohio are still found in parts of the United States; and the passenger pigeon, Louisiana parakeet and the Eskimo curlew, which are not extinct.

The American Indians, who lived in, or visited the Ohio territory before the white man came, were hunters and small scale farmers. They are said to have occasionally burned off small areas and raised some corn, beans and pumpkins. Their inroads on wildlife were of much importance to their own welfare but probably had little effect on the fish and game populations.

With the coming of the White man to the Ohio territory, habitat conditions then existing were altered. The early settlers reached considerable numbers first along the Ohio River and its tributaries and along the southern shore of Lake Erie. In 1800 there were only 45,000 white men in the territory. The Indians were forced out of the state about 1845. By 1850 most of the counties in the eastern half of the state had reached their maximum rural population (Beck 1934). Settlement was practically complete by 1880 except for a few areas, most of which were in the poorly drained Maumee plain of northwestern Ohio. It was here that many of the larger forest species were last reported in Ohio. In 1840 agriculture was still the chief industry, but by 1930 Ohio had become an industrial state with less than one-sixth of its population living on farms (Beck *op. cit.*).

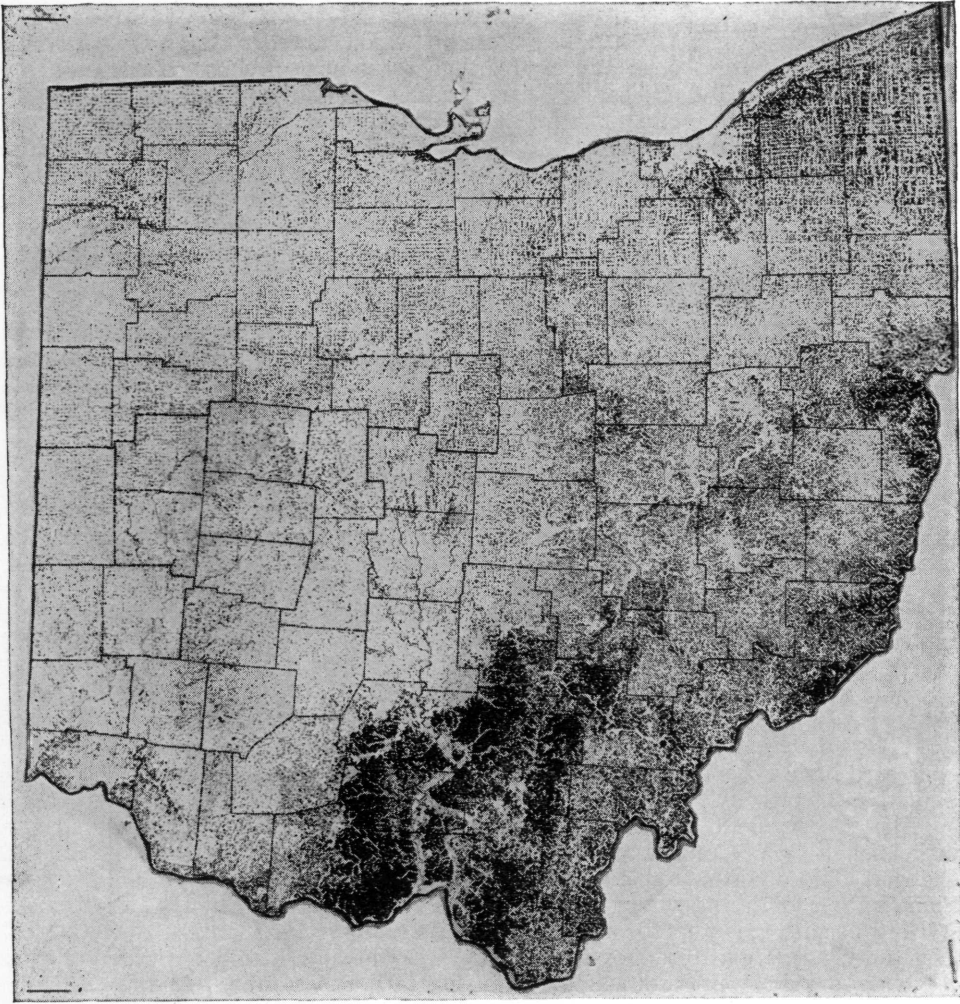
The most marked ecological change produced by the settlement of Ohio came as a result of the clearing away of the forests which began in the southeastern counties about 1788. The land was cleared not only for agriculture, but also in the interest of mining, salt and steel industries, which required large supplies of wood for mine props, fuel and charcoal. By 1890 forest clearing in Ohio was nearly complete, the rural population had reached a maximum and some of the earliest cleared land in southeastern Ohio was already being abandoned. (Sitterley and Falconer, 1938).

SOME HABITAT CHANGES RESULTING FROM THE SETTLEMENT AND DEVELOPMENT OF OHIO

Disappearance of forest cover and the plowing of the virgin soil (all too frequently up and down the slopes) accelerated erosion. The streams became silt laden and flooding was possibly more frequent and extensive. By the mid-1930's about 32 per cent of the state was affected by moderate sheet erosion and 16 per cent, mostly in east central and southeastern Ohio, was severely eroded. (Conrey, Cutler and Paschall, 1937).

Clearings made by the first pioneers were only small openings in the forest. In the more rugged sections of southern and eastern Ohio the remaining wooded areas later assumed a dendritic pattern, following streams, steep-sloped ravines and rough terrain. Forest edge thus provided was especially valuable for such species as the bob-white quail. In the more level areas of north-central and northwestern Ohio, 80 to 90 per cent of the woods were eventually removed leaving scattered, rectangular woodlots separated by much larger blocks of open farm lands with a few connecting arms or brushy fencerows to be used as travel lanes by wild animals.

In addition to the cutting of the forests, the draining of sizeable swamp and marsh lands in northern Ohio greatly altered the wildlife habitat and converted the former into some of the richest agricultural land of the state. In Wood County alone there are now more than 2,000 miles of open drainage ditches. These ditches provide travel lanes, cover and food for many animals including muskrats, which feed on the crops (corn, soybeans, alfalfa, etc.) now grown in adjacent fields.



Forest cover of Ohio. "Prepared by Forest Survey, Ohio Agricultural Experiment Station, Wooster, in cooperation with Central States Forest Experiment Station, Columbus. Map compiled from aerial photographs provided by Agricultural Adjustment Administration. Black areas indicate woodlands." (See Ohio's Forest Resources, Forestry Publication No. 76. Ohio Agr. Expt. Sta. and Central States Forest Expt. Sta.)

With the rapid growth of cities and industrial plants in Ohio, wastes, both human and industrial, were poured into Ohio streams, often affecting fish and other aquatic life adversely. Mr. E. L. Wickliff, Chief of the Fish Management Section of the Ohio Division of Conservation and Natural Resources, in conversation January 25, 1948, stated that fish may be exterminated locally as a result of habitat changes but few have been completely extirpated from Ohio and a few have been introduced by man.

The streams (some 12,000 miles of them) which flowed through Ohio's virgin forests were probably cooler and clearer than those now present. They probably had frequent pools and eddies due to trees falling across them, and they also probably had an abundant food supply for fish. The silt and mud found in our streams are there today because of erosion. The suspended silt particles tend to absorb more of the sun's rays, thus making the water warmer, and through reduced photosynthesis, decrease the amount of aquatic vegetation and other organisms available for fish food. Langlois (1941) pointed out these and other relationships obtaining in the southwestern part of Lake Erie and indicated the adverse effect silt had on ciscoes, whitefishes and yellow perch.

Originally there were only ten to twelve square miles of impounded water (lakes) in the Ohio area. Today there are more than 100 square miles of such water with many farm ponds and lakes under construction and others projected for future building. Thus the habitat for such species as the white crappie, blue gill, largemouth bass, channel catfish, bullhead catfish, pumpkinseed, black crappie and yellow perch has been greatly increased.

SOME CHANGES IN OHIO FAUNA RESULTING FROM HABITAT ALTERATIONS

We have seen that Ohio was changed, through settlement, from what was once primarily a deciduous forest environment, to an agricultural land with prairie-like characteristics. Many typically forest animals were extirpated while other animals, more adapted to the new environment, moved into Ohio or increased in numbers after the country was settled. Among the mammals which are more abundant in Ohio than originally are the thirteen-lined ground squirrel or spermophile, prairie white-footed mouse, meadow mouse or vole, badger, and the introduced Norway rat and house mouse. The cottontail rabbit, skunk, opossum, muskrat, fox squirrel and prairie mole are also probably much more common now than formerly. There is apparently some question about the occurrence of the red fox in the Ohio area before the White man came. If it did occur originally, it was less abundant than at present.

The vesper, field, Savannah, grasshopper and Henslow's sparrows, and the dickcissel, bobolink and prairie horned lark have evidently benefited from the changed Ohio environment and are more abundant than formerly. Other birds such as the robin, housewren, nighthawk and the introduced English sparrow and starling became adapted to man's settlements and greatly increased in numbers. The red-winged blackbird now frequently nests in alfalfa and red clover fields, cover types which were not available in the Ohio wilderness area. Among the more southern species which have extended their ranges northward are the Carolina wren, cardinal, tufted titmouse, mockingbird and chuck-will's widow.

Such fishes as the bluegill, crappie and large-mouthed bass which are adapted to living in lakes and ponds are much more abundant than originally due to the increased habitat resulting from man's pond and lake building activities. Some changes in fish distribution have also taken place. Mr. E. L. Wickliff reports that the sucker-mouth minnow apparently invaded Ohio from the west and is adapting itself to the streams of central and eastern Ohio. Also with the building of Ohio canals the white crappie moved northward in the state.

In general what has been said about the changes occurring in the population of mammals, birds and fish probably also applies to insects and other forms of life,

namely, forest species have decreased in numbers, whereas prairie species such as many of the leafhoppers, grasshoppers and plant bugs have increased. Although many of the economically important insects are exotics, having been accidentally introduced here by man, the chinch bug is a native species that originally lived in the corn belt area where it infested prairie grasses such as *Andropogon* sp. Man plowed up this area and planted the cultivated grasses, wheat and corn. The chinch bug became adapted to the new conditions and now attacks both plants.

This brief summary of changes brought about by civilization indicates some of the general relationships existing between man and wildlife. It indicates how man can drive out animals by destroying or altering habitat and how, often unwittingly, he can create new habitat conditions which will enable other animals to live and multiply in number.

Although Ohio's wildlife belongs to the people of the state, the bulk of the wildlife (probably more than 90 per cent) is produced, as an unplanned crop, on privately-owned lands. It is obvious that the landowner is in a key position to manage wildlife, and the State, which owns only a small percentage of the land in Ohio, must either devote its efforts to managing this small publicly owned area or to working through the landowner in any program which involves extensive wildlife habitat development. The landowner has but little incentive to produce more game on his land under present day conditions when, in most instances, he receives no remuneration from the hunters and when, as he realizes, the more game he has on his property the more people he will have hunting or asking to hunt on his land. The farmer knows also that many, though not all, of the wildlife management measures he can practice, take land out of crop production and thus cost him money. The owners of some waterfowl and muskrat marshes have learned that they can manage the marshes for profit. They harvest the muskrats and charge fees for waterfowl hunting privileges. Fortunately for the "one-gallus hunter", most landowners are quite willing to permit upland game hunters on their property as guests as long as they respect the property and behave as true sportsmen.

In developing a program of game management in Ohio the land use—wildlife relationships mentioned below should be recognized. Obviously, since game is a secondary crop in Ohio, most of the agricultural practices affecting wildlife will be altered for the benefit of wildlife only insofar as the landowners are assisted in their game management efforts or are shown that certain management measures are beneficial to their interests.

1. *Cultivated crops as wildlife food*

Yellow corn is probably the most important wildlife food in Ohio, being consumed by pheasants, squirrels, raccoon, muskrats, deer and many other animals. Of great importance also are wheat and soybeans. The production of these crops has increased during recent years in much of Ohio. In six pheasant belt counties, for example, the acreage devoted to soybeans was increased 78.9 per cent from 1940 to 1945, while corn and wheat acreages were increased 5.0 and 15.6 per cent respectively (Ray et al., 1943, 1946). Smartweed, lesser ragweed and fox-tail grasses commonly associated with these crops are also excellent wildlife foods and increase in abundance as the acreages in row crops increase. Extensive use of herbicides such as 2, 4-D may, however, materially reduce this source of food and cover in the future.

2. *Harvesting methods as they affect the availability of cultivated crops for wildlife foods*

Mechanical corn picking is rapidly taking the place of the cutting and husking method of corn harvesting. Field observations in a large part of the pheasant belt of western and northwestern Ohio indicated that only about 10 per cent of the corn was picked in 1936 compared to 70 per cent in 1946. Since most of the picked

corn is now harvested by machine instead of by hand, and since mechanical pickers leave more waste grain in the fields than the other methods, the increased use of machine pickers has resulted in an increased amount of waste corn, available except under ice and deep snow, as wildlife food.

Soybeans, when grown for hay, pasture or green manure, are of relatively little direct value to wildlife but when combined for grain the waste beans are utilized by pheasants, rabbits and other animals as food. According to Ray *et. al.*, (1943) the percentage of soybeans in Ohio which was harvested for grain increased from 49.1 in 1936 to 73.0 in 1941. The author (Leedy 1939) found by sampling fields in Wood County, Ohio, an average of approximately 292 pounds of corn left per acre in machine-picked corn fields and 227 pounds of soybeans per acre in combined soybeans. He also found smartweed seed produced at an average rate of more than 47 pounds per acre in corn and soybean fields sampled and ragweed seed at a rate of approximately 86 pounds per acre in unclipped wheat stubble. It is thus apparent that much food in the form of waste grain and weed seeds is available to wildlife in intensively farmed areas where the limiting factor is likely to be lack of adequate wildlife cover.

3. *Agricultural Crops as Wildlife Cover*

Since agricultural crops constitute the bulk of the cover now present in Ohio it is expected that they should be used as such by wild animals. Such cover is at a maximum during midsummer but is gradually reduced by harvesting, stubble clipping and plowing so that only a relatively small amount is left by March. Wild animals shift from field to field until by spring they are often concentrated in a semi-permanent type of cover consisting of a few brushy fencerows, woodlots, ditch banks, and idle fields. Spring burning of ditch banks, fencerows, and roadsides reduces this cover still further.

During the years 1939 to 1941 nesting studies made in the Ohio pheasant belt by the Ohio Wildlife Research Unit indicated that approximately two-thirds of the pheasants nested in hay meadows. Many rabbits also have their nests in meadows. According to Ohio Agricultural Statistics (Ray *et al.*, 1946) there was a reduction of 24.4 per cent in hay acreage in six Ohio pheasant counties from 1940 to 1945. This trend has probably been detrimental to pheasants and other birds such as the red-winged blackbird, sparrows, dickcissel, and meadowlark which nest in meadows. For example, studies made in southwestern Ohio (Dambach and Good, 1940) indicated about 50 pairs of breeding birds per 100 acres of meadow compared to an average of ten pairs per 100 acres of small grains.

Unclipped wheat stubble left by combines provides excellent roosting sites for pheasants throughout the fall and even during the winter and early spring months. Standing corn also provides superior cover; it is frequented by pheasants, rabbits, bob-white quail and other animals. Although machine pickers break over the corn stalks, more cover is left in the fields than when the corn is cut and husked or put into silos.

4. *Ohio woodlots and forest areas in relation to wildlife*

Although woodlots and forests now constitute only about 14 per cent of the total land area in Ohio (Pl. I) they provide the year around home for many animals and the part time home of several other animals. In the more heavily forested area of eastern Ohio white-tailed deer and beaver are reappearing and extending their range after having been extirpated. Based on the estimate of game protectors there was approximately 9,300 deer in Ohio, 1947 as compared with 4,400 reported in 1943, indicating an increase of 114 per cent in four years (Leedy, 1947). According to Sitterley (1944), during the first 40 years of the present century the number of farms in the southeastern third of Ohio dropped from 86,759 to 73,073 and the land in farms from 8,148,134 acres to 6,949,919 acres. The shift in land use

from farms to woodland is apparently still in progress and there are approximately 1,500,000 acres of marginal or submarginal land best suited to be in forest, bringing the potential woodland area of Ohio to 5,207,598 acres or one acre in woods out of every five acres of land area (Diller, 1944). The retirement of farm units and the increased acreage of forest land are providing more habitat for grouse, gray squirrels, deer and beavers.

In the larger, glaciated section of Ohio most of the forest cover is in the form of isolated woodlots. In the western part of the state more than three-fourths of these woodlots are pastured. Woodlot pasture is inferior in quality and quantity to rotation pasture. The practice of woodland pasturing is not only detrimental to most forms of wildlife but reduces the production of other forest products including lumber, fire wood and maple syrup.

Dambach (1944) found, in comparing a grazed and an ungrazed woodlot in Geauga County, Ohio, that for a five-year period breeding birds in the ungrazed area were four times more abundant and represented twice as many species as those in the grazed woodlot. He estimated that there were 81 mammals per acre in the ungrazed as compared to 49 per acre in the grazed woodland at the end of a ten-year period. In Butler County in southwestern Ohio, Dambach and Good (1940) found approximately twice as many pairs of breeding birds in ungrazed as compared with pastured woodlots.

The author, working in Wood County, Ohio, in 1937 recorded 19,891 pheasants of which 23.6 per cent were seen in woodlots. The woods were apparently of greatest value in the winter, when 37.3 per cent of all pheasants seen were in that type of cover, and least utilized in summer, when only 5.4 per cent were in woods. More than three-fourths (76.9 per cent) of the pheasants seen in woods were within 25 yards of the outside edges. Woodlots harboring the most pheasants were ungrazed, or if grazed, had patches of wild roses, brambles, prickly ash, *Crataegus* or other protective cover in them. In addition to providing cover of much value to pheasants in the winter and early spring, woodlots are also used for roosting sites and to some extent for feeding and nesting sites.

The fox squirrel, an animal of the prairie edge, is undoubtedly more abundant in Ohio now than under the original forested conditions. It is able to live in farm woodlots on hickory nuts, acorns, beechnuts, black walnuts, buds and other natural foods, often supplemented by corn grown in adjoining fields.

5. *Field borders in relation to wildlife*

Next to woodlots, field borders provide the most extensive semi-permanent type of cover available to wildlife in Ohio. They offer some of the best possibilities for developing a wildlife habitat improvement program. They are of much value in providing various types of cover and food for animals living part or full time in such cover and they also function as travel lanes for animals in going from one area to another. Field border travel lanes thus make it possible for some animals to utilize areas that would otherwise be unavailable to them.

Many investigators have noted the value of brushy field borders in providing cover for birds. In Ohio, Dambach (1945) found that field borders composed largely of woody plants, are occupied by many more nesting birds and beneficial mammals such as the short-tailed shrew than are nonwoody borders. Conversely he found that borders, consisting largely of blue-grass, supported high populations of destructive species such as the meadow vole, pine mouse, lemming, prairie white-footed mouse and house mouse. In Wood County, Leedy (1940) found that dense, brushy fencerows were utilized by pheasants in winter 30 times more than clean fencerows in the same area. The brushy fencerows were also found to be much more valuable as travel lanes than clean or sodded field borders.

In intensive field border studies made in southwestern Ohio, Dambach (1945) learned that shrubby fencerows less than four feet in width and six feet in height

had little effect on the yields of adjacent crops. He found that "the more nearly the vegetation in a crop field border is related to the adjacent crops, the greater is the danger of its serving as a center for infestation of crops by insect and small mammal pests". It seems obvious from these findings that some type of shrubby field border is to be desired for wildlife between or adjacent to grain and forage crops and that sod or herbaceous types of field borders are less harmful around orchard crops. Dambach's studies also point out the need for further research in developing shrubby plants that will be easily managed, provide adequate wildlife cover and not compete with adjoining crops.

Fences of one type or another become an essential part of the farm habitat whenever livestock is included in the agricultural program. For the most part there is some conflict or competition between livestock and wildlife. Pasturing, cutting and burning are the three practices which are responsible for keeping more than one-half of Ohio's fencerows so clean that they contribute little to the production of game animals. Cutting, burning and other fencerow cleaning operations have been shown to be effective in controlling only a relatively few crop pests but these operations effectively reduce food and cover for wildlife and result in some mortality and nest destruction. Obviously most fences are built to hold stock or to form property lines between farms. The ratio of fenced and fenceless field borders serves as an indicator of the relative amount of pasturing done in different counties. In livestock and dairying areas the percentage of fields with fences is high; in cash grain crop areas the percentage of fields with fences is relatively low.

In 1939-1940 a survey (Leedy, 1940) was made of some 16,800 fencerows in 24 counties scattered throughout Ohio. This study indicated that unfenced, and therefore unpastured, field borders often contained more cover than fenced field borders.

In Wood County, it was found that only 38 per cent of the fields were separated by fences compared to 93 per cent in Madison County. Wood County has a relatively high pheasant population and Madison County, a relatively light pheasant population. It is likely that the different agricultural practices followed in these counties and reflected in the number of pastured fields are partly responsible for the differences in the population of pheasants and other wildlife.

During the 1939-1940 survey fencerows were evaluated according to their potential winter cover for pheasants. Only 816 of them (4.8 per cent) were considered as providing superior winter cover consisting largely of shrubs, sprout growth and briers. Dambach (1945) recorded only 5.9 per cent of the field borders in his study area as shrub borders. It is apparent that much remains to be done to develop Ohio's field borders so that they will contribute to larger wildlife crops.

Interesting also are the kinds of fences observed in the above-mentioned survey (Leedy, 1940). Of 2,692 fences classified in 20 Ohio counties, the following percentages were noted by type: wire, 81.94; barbed wire, consisting of two or more strands, 13.71; electric, 1.75; rail fence, only .67; other fences, 1.93. The decrease in use of the rail fence has very probably been detrimental to such species as chipmunks. Electric fences have been unfavorable to wildlife inasmuch as they make it possible to quickly fence an area for pasturing and result in fewer permanent field borders. A survey made in Wood County, 1938, showed that approximately 15 per cent of the corn fields were pastured after having been picked. Of these pastured corn fields 42 per cent were partially or entirely enclosed by electric fences (Leedy, 1939).

6. *Miscellaneous practices and trends as they affect wildlife*

In addition to the wildlife-landuse relations pointed out above certain other practices and trends should be mentioned. Among these are the soil conservation practices including strip cropping, contour cultivation and land planning in which

acres of row crops are reduced and acreages devoted to forestry, wildlife and pasture are increased. Soil conservation practices resulted in net gains of 37.7 per cent and 44.9 per cent respectively of breeding birds on demonstration areas in southeastern Ohio and southwestern Ohio (Good and Dambach, 1943).

In the northwestern Ohio oil fields in former years, thousands of "rod lines" radiated from hundreds of engines transmitting power to the oil well pumps. These iron rod lines cut across fields in such a way that numerous odd corners were left to grow up to weeds and brush thus providing valuable game coverts in addition to the strips of cover left along the rod lines themselves. These rod lines are being taken up now that the oil is gone and large fields are being substituted for the numerous small and odd-shaped fields that once provided a greater variety of cover.

Strip-mining is becoming more general in the eastern Ohio coal fields. Thousands of surface acres have been and are being stripped of coal by power shovels which leave the raw overburden in series of steep-sloped ridges. Studies now being made in Ohio by Charles V. Riley, graduate student at the Ohio State University, as well as investigations made in other states indicate good possibilities of developing these areas for wildlife and forestry.

The development of new varieties of agricultural crops have both beneficial and detrimental effects on wildlife. Generally speaking the greater the yield of a given crop the more waste there will be left as wildlife food when the crop is harvested. However, some of the hybrid corn now grown, for example, stands up better and is picked cleaner than older varieties which yielded less per acre. An earlier maturing variety of timothy (Huron) is now being grown on a small scale in Ohio. If timothy and other hay crops were harvested earlier, the destruction of pheasant nests would be greater than it is now since more unhatched nests would be present at haying time.

Harvesting methods are an important influence on wildlife because of their effect on food and cover as pointed out earlier and also because of the resulting destruction to wild animals and their nests. Pheasant casualties as a result of hay mowing increased approximately 60 per cent from 1938 to 1946 mainly because of the increased use of power mowers. Careful counts made in 590 acres of alfalfa cut for Wood County dehydrating mills in 1946 revealed 106 adult female pheasants and 74 juvenile pheasants which had been killed by mowers. A total of 193 other dead vertebrates including 37 cottontail rabbits, were also killed. (Leedy and Dustman, 1947).

The destruction of unhatched nests together with such casualty rates indicate the importance of establishing undisturbed nesting areas as a part of a pheasant and rabbit management program. Investigations devoted to the development of an efficient type of flushing bar which would save many of these animals from being killed, would also seem to be justified.

The practice of clipping small grain stubble fields following the harvest is becoming more prevalent. Clipping the stubble reduces the amount of fall and winter cover available, decreases the amount of food and apparently decreases the attractiveness of the cover in the next year's hay crops for pheasant nesting.

SUMMARY

1. Protective and restrictive game legislation, artificial propagation and restocking of game, and establishment and maintenance of game refuges have been inadequate in keeping the supply of game in Ohio sufficiently high to meet the growing demands of the hunters.

2. Recognizing the food and cover requirements of the species, habitat development is recommended as a practical approach to the problem.

3. Changes in the Ohio environment due to settlement and development have brought about marked changes in the flora and fauna. Many typically forest

animals were extirpated, while other animals, more adapted to the changed environment, moved into Ohio or increased in numbers after the country was settled.

4. Although Ohio's wildlife is held in trust by the State for all the people, the bulk of the wildlife is produced as an unplanned crop on privately-owned farms.

5. The landowner is in a key position to manage wildlife through his control of the natural habitat but has little incentive for so doing without some assistance, financial or otherwise, from the army of sportsmen which desires hunting privileges.

6. Wildlife-land use relationships which are involved in the development of a wildlife management program based on habitat improvement, are discussed under the following headings: (a) cultivated crops as wildlife food; (b) harvesting methods as they affect the availability of cultivated crops for wildlife foods; (c) agricultural crops as wildlife cover; (d) Ohio woodlots and forest areas in relation to wildlife; (e) field borders in relation to wildlife and (f) miscellaneous practices and trends as they affect wildlife.

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